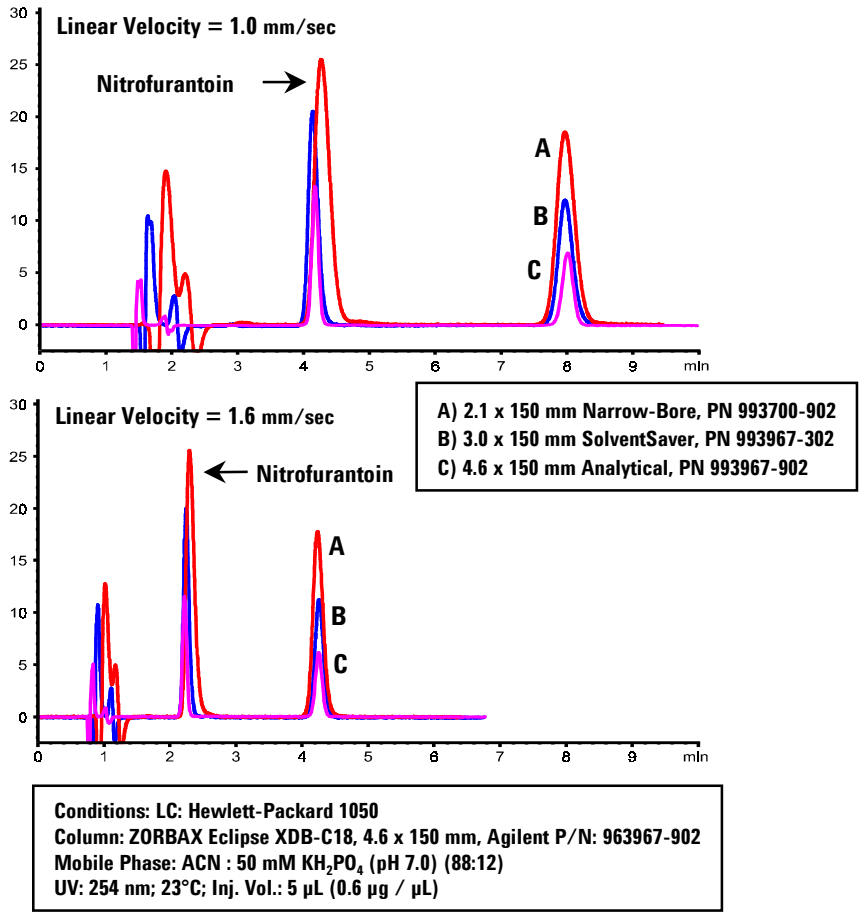
# Benefits of Using Smaller-Diameter Columns

## Application

## Technical

Robert Ricker

The United States Pharmacopeia (USP) method for nitrofurantoin HPLC assay requires a 3.9 x 300 mm column with L1 packing (commonly called C18 or ODS), adjusting the operating parameters so nitrofurantoin retention is about 8 minutes. We performed the assay with a 4.6 x 150 mm column; therefore the nitrofurantoin retention was adjusted to about 4 minutes (left panel, cgm. A, flow= 1 mL/min.). This assay was easily performed using a Solvent-Saver 3.0 x 150 mm column and a Narrow-Bore 2.1 x 150 mm column, decreasing flow rate to obtain the same linear velocity.




**Conditions: LC: Hewlett-Packard 1050**
**Column: ZORBAX Eclipse XDB-C18, 4.6 x 150 mm, Agilent P/N: 963967-902**
**Mobile Phase: ACN : 50 mM $KH_2PO_4$ (pH 7.0) (88:12)**
**UV: 254 nm; 23°C; Inj. Vol.: 5 µL (0.6 µg / µL)**

### *Highlights*

- *Modernizing HPLC methods with ZORBAX Solvent-Saver or Narrow-Bore columns offers improvement in lab productivity:*
  - *An increase in instrument sensitivity (peak response)*
  - *Savings in time*
  - *Reduced solvent consumption*

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One advantage of using smaller-diameter columns is increased peak response. Note the increase in peak height as the column diameter decreases. Peak response for the 2.1 mm i.d. column is 3 times greater than that of the 4.6 mm i.d. column. This is beneficial when analyzing mass limited samples, typically used in LC/MS applications.

Another advantage of using smaller-diameter columns is decreased solvent usage. Because less mobile phase is required to achieve the same linear velocity, analysis time can be reduced by increasing flow rate. One can spend about 9 mL of mobile phase and 9 minutes analysis time using the 4.6 mm i.d. column and 1.0 mL/min. flow rate (left panel, cgm. A), or only 2 mL mobile phase and about 5 minutes using the 2 mm i.d. column and 0.33 ml/min. flow rate (right panel, cgm. C). The latter is a 40% savings in time and solvent, but still exceeding USP's requirements. Savings are even greater if comparing the 2.1 x 150 mm column to the original 3.9 x 300 mm USP reagent column.

The slight shift in retention of the nitrofurantoin peak on the Narrow-Bore column is due to extra-column volume. This LC system was not optimized for low-volume columns. Extra-column volume reduces column efficiency, especially for early eluting peaks.

*Robert Ricker is an application chemist based at Agilent Technologies, Wilmington, Delaware.*

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